1 The equation $s = 2\sqrt{5x}$ can be used to estimate the speed, s, of a car in miles per hour, given the length in feet, x, of the tire marks it leaves on the ground. A car traveling 90 miles per hour came to a sudden stop. According to the equation, how long would the tire marks be for this car?

A 355 feet

B 380 feet

C 405 feet

D 430 feet

$s = 90$

$\frac{90}{2} = \frac{2\sqrt{5x}}{2}$

$(45)^2 = (\sqrt{5x})^2$

$\frac{2025}{5} = \frac{5x}{5}$

$x = 405$

2 The heights of two different projectiles after they are launched are modeled by $f(x)$ and $g(x)$. The function $f(x)$ is defined as $f(x) = -16x^2 + 42x + 12$. The table contains the values for the quadratic function g.

x	$g(x)$
0	9
1	33
2	25

$g(x) = -16x^2 + 90x + 9$

use stat edit L_1, L_2 quad reg.

ind calc

$x = \frac{-b}{2a}$ ← time

$y = f\left(\frac{-b}{2a}\right)$ ← height

What is the ***approximate*** difference in the maximum heights achieved by the two projectiles?

A 0.2 feet

B 3.0 feet

C 5.4 feet

D 5.6 feet

$f(x) \rightarrow x = \frac{-42}{2(-16)} = \frac{-42}{32} = \frac{21}{16}$

$y = f\left(\frac{21}{16}\right) = 39.563$

$g(x) \Rightarrow x = \frac{-90}{2(-16)} = \frac{5}{4}$

$y = f\left(\frac{5}{4}\right) = 34$

$39.563 - 34 = 5.563$

round to ≈ 5.6 ft

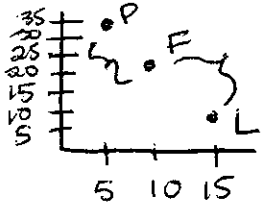
3 A city map is placed on a coordinate grid. The post office is located at the point $P(5, 35)$, the library is located at the point $L(15, 10)$, and the fire station is located at the point $F(9, 25)$. What is the ratio of the length of $\overline{PF}$ to the length of $\overline{LF}$?

A 2 : 3

B 3 : 2

C 2 : 5

D 3 : 5



$LF = \sqrt{(15-9)^2 + (10-25)^2}$

$= \sqrt{(6)^2 + (-15)^2}$

$\overline{LF} = \sqrt{261}$

Ratio $\frac{\overline{PF}}{\overline{LF}} = \frac{\sqrt{116}}{\sqrt{261}} = \frac{2}{3}$

distance $= \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

$\overline{PF} = \sqrt{(9-5)^2 + (25-35)^2}$

$= \sqrt{(4)^2 + (-10)^2}$

$\overline{PF} = \sqrt{116}$

4 Twenty-one students at a school have an allergy to peanuts, shellfish, or both.

- Fourteen students at the school are allergic to peanuts.
- Twelve students at the school are allergic to shellfish.

How many of the students are allergic to both peanuts and shellfish?

A 12

B 7

C 5

D 2

$P + S - P\&S = 21$

$14 + 12 - \text{Both} = 21$

$26 - \text{Both} = 21$

$-26 \quad -26$

$-\text{Both} = -5$

Both = 5

5 Events M and N have probabilities such that $P(M) = 0.4$, $P(N) = 0.28$, $P(M \cup N) = 0.56$, and $P(M \cap N) = 0.12$. Are event M and event N independent?

A no, because $P(M) - P(N) = P(M \cap N)$

B no, because $P(M) \cdot P(N) \neq P(M \cap N)$

C yes, because $P(M) + P(N) = P(M \cup N)$

D yes, because $P(M) \cdot P(N) \neq P(M \cup N)$

$.4(.28) = .112$

$.112 \neq .12$

independent $\rightarrow P(M \cap N) = P(M) \times P(N)$

6 Which expression is equivalent to $(3x^5 + 17x^3 - 1) + (^-2x^5 - 6)$?

A $x^5 + 17x^3 - 7$

B $x^5 - 11x^3 - 1$

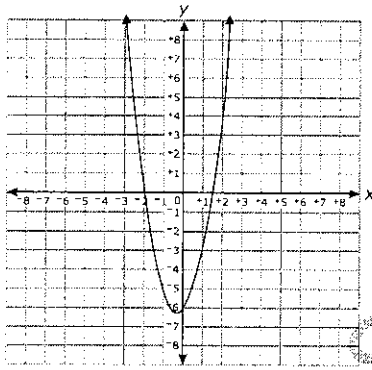
C $5x^5 + 17x^3 + 7$

D $^-6x^5 + 17x^3 + 6$

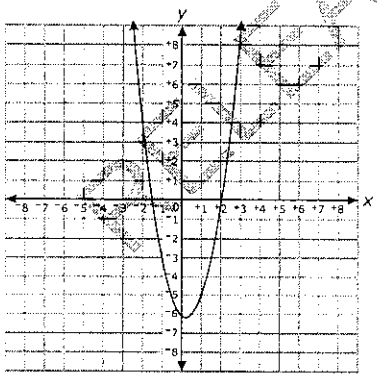
$x^5 + 17x^3 - 7$

7 Which graph displays the function $f(x)=(2x + 3)(x - 2)$?

A



B



$2x^2 - 4x + 3x - 6$

$f(x) = 2x^2 - x - 6$

plug into calculator

compare

or look at zeros

$(2x + 3) = 0$

$2x = -3$

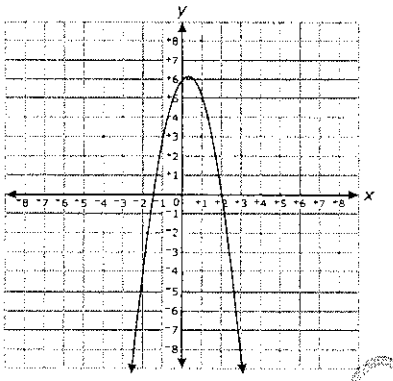
$x = \frac{-3}{2} = -1.5$

$x - 2 = 0$

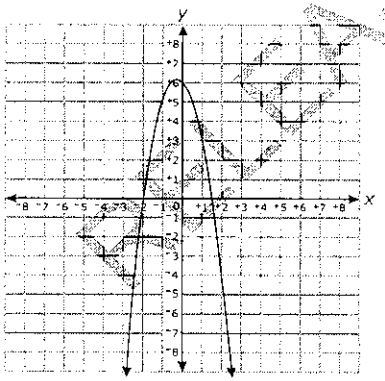
$x = 2$

Answer choices C and D are on the following page.

C



D



$x+y=24$ $\quad x^2+y^2=306$

$y=-x+24$ $\quad y^2=-x^2+306$

Plug into y_1 and into y_2 $\quad y=\sqrt{-x^2+306}$

300m fit → "0" and then 2nd trace intersect

8 The sum of two numbers is 24. The sum of the squares of the two numbers is 306. What is the product of the two numbers?

A 119

B 128

C 135

D 144

$x=9 \quad y=15$

$xy=9(15)=135$

9 Which equation has exactly one real solution?

A $4x^2 - 12x - 9 = 0$ — 2 real

B $4x^2 + 12x + 9 = 0$ — one real

C $4x^2 - 6x - 9 = 0$ — 2 real

D $4x^2 + 6x + 9 = 0$ — 0 real

graph & look at x-axis for x intercepts or the table where $x=0$

10 A circular pond is modeled by the equation $x^2 + y^2 = 225$. A bridge over the pond is modeled by a segment of the equation $x - 7y = -75$. What are the coordinates of the points where the bridge meets the edge of the pond?

A (9, 12) and (−12, 9)

B (9, 12) and (12, 9)

C (9, −12) and (−12, −9)

D (−9, 12) and (12, −9)

$-7y=-x-75$

$y=-\frac{1}{7}(-x-75)$ → y_1

$y^2=-x^2+225$

$y=\sqrt{-x^2+225}$ → y_2

intersections

(−12, 9) & (9, 12)

11 The volume, V, of a certain gas varies inversely with the amount of pressure, P, placed on it. The volume of this gas is 175 cm^3 when 3.2 kg/cm^2 of pressure is placed on it. What amount of pressure must be placed on 400 cm^3 of this gas?

A 1.31 kg/cm^2

B 1.40 kg/cm^2

C 2.86 kg/cm^2

D 7.31 kg/cm^2

$V = \frac{K}{P}$ $175 = \frac{K}{3.2}$

$K = 560$

$V = \frac{560}{P}$ $400 = \frac{560}{P}$

$P = \frac{560}{400} = 1.4$

12 A company manufactures DVDs.

- The company spent $247,000 to develop its process for manufacturing the DVDs.
- The company spends an additional $1.25 to manufacture each DVD.

Which function represents the average total cost per DVD, y, for the company to manufacture x total DVDs?

A $y = \frac{x}{1.25x}$

B $y = \frac{1.25x}{x}$

C $y = \frac{x}{1.25x + 247{,}000}$

D $y = \frac{1.25x + 247{,}000}{x}$

Cost of DVD = $\frac{\text{Total cost}}{\#\text{ DVD's you sell}}$

13 For a carnival game, a jar contains 20 blue marbles and 80 red marbles.

- Children take turns randomly selecting a marble from the jar.
- If a blue marble is chosen, the child wins a prize.
- After each turn, the marble is replaced.
- Casey has drawn six red marbles in a row.

Which statement is true?

A If Casey selects another red marble, then 2 of her next 3 picks will be blue marbles because 2 blue marbles are selected for every 8 red marbles selected.

B The probability that Casey selects a blue marble on the next turn is higher than it was on her last turn because she has chosen so many red marbles in a row.

C The probability that Casey selects a blue marble on her next turn is the same as it was on the last turn because selections are independent of each other.

D If Casey draws 4 more times, she will select 2 blue marbles because the probability that a blue marble will be selected is 2 out of every 10 turns.

14 A plane intersects a regular triangular pyramid. The plane is parallel to one of the faces of the pyramid. What type of polygon is formed at the intersection?

A square

B right triangle

C isosceles trapezoid

D isosceles triangle

15 The number of bacteria in a culture can be modeled by the function $N(t) = 28t^2 - 30t + 160$, where t is the temperature, in degrees Celsius, the culture is being kept. A scientist wants to have fewer than 200 bacteria in a culture in order to test a medicine effectively. What is the ***approximate*** domain of temperatures that will keep the number of bacteria under 200?

A $-1.01°C < t < 2.03°C$

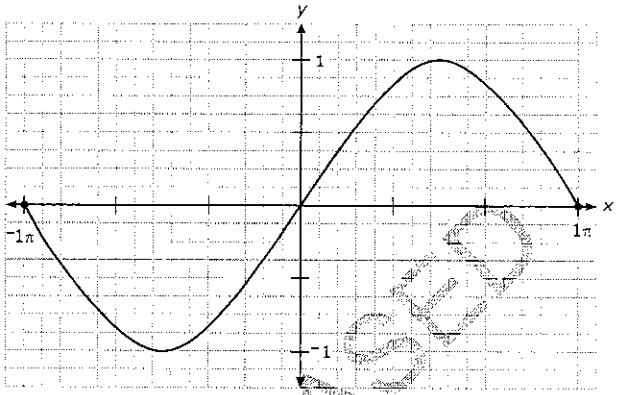
B $-0.90°C < t < 1.97°C$

C $-0.86°C < t < 1.93°C$

D $-0.77°C < t < 1.85°C$

put $N(t) = 28t^2 - 30t + 160$ into calc & set table to ask then see which interval is < 200 !

16 Which function is graphed below?

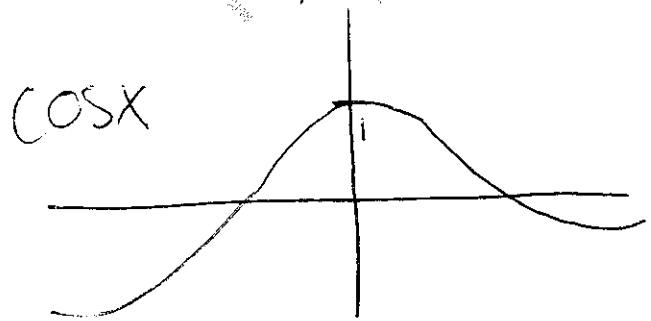


A $y = \sin x$

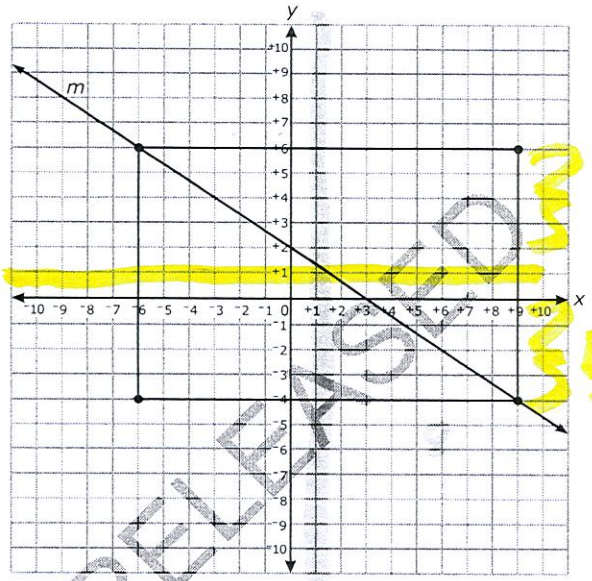
B $y = \cos x$

C $y = \tan x$

D $y = \cot x$



17 Which transformation will carry the rectangle shown below onto itself?



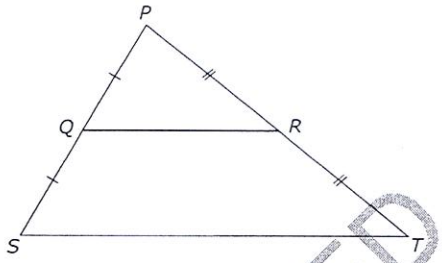
A a reflection over line m

B a reflection over the line $y = 1$

C a rotation 90° counterclockwise about the origin

D a rotation 270° counterclockwise about the origin

18 Which statement must be true about the triangle below?



A $PQ + QS = PR + RT$

B $\triangle PQR \cong \triangle PST$

C $ST = 2 \cdot QR$

D $\angle S \cong \angle T$

19 The graph of $f(x) = x^2$ will be translated 5 units up and 2 units to the right. Which function describes the graph produced by the translation?

A $g(x) = x^2 - 4x + 9$

B $g(x) = x^2 + 4x - 1$

C $g(x) = x^2 - 10x + 27$

D $g(x) = x^2 + 10x + 23$

20 An investment has a balance of $2,000 and earns 3.2% interest each year. If $150 is added at the end of each year by the account holder and no money is withdrawn from the investment, which represents a function that can be used to calculate the investment balance for successive years?

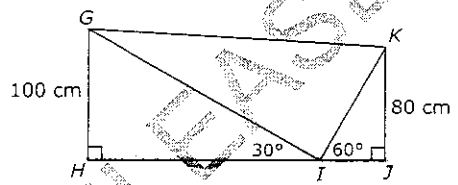
A $B_n = 0.032B_{n-1} + 2{,}000,\ B_0 = 150$

B $B_n = 0.032B_{n-1} + 150,\ B_0 = 2{,}000$

C $B_n = 1.032B_{n-1} + 2{,}000,\ B_0 = 150$

D **$B_n = 1.032B_{n-1} + 150,\ B_0 = 2{,}000$**

21 What is the ***approximate*** length of $\overline{HJ}$ in the diagram below?



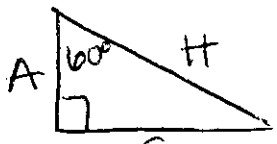
A 292 cm

B 265 cm

C 219 cm

D 196 cm

$173.2 + 46.2 = 219.2 \approx 219$



$\tan 60° = \frac{80}{A}$

$A = \frac{80}{\tan 60°} = 46.2$

22 Angles F and G are complementary angles.

- As the measure of angle F varies from a value of x to a value of y, $\sin(F)$ increases by 0.2.

How does $\cos(G)$ change as F varies from x to y?

A It increases by a greater amount.

B It increases by the same amount.

C It increases by a lesser amount.

D It does not change.

23 If t is an unknown constant, which binomial must be a factor of $7m^2 + 14m - tm - 2t$?

A $7m + t$

B $m - t$

C $m + 2$

D $m - 2$

$(7m - t)(m + 2)$

foil backwards to get factors

24 The value, V, of a car can be modeled by the function $V(t) = 13{,}000(0.82)^t$, where t is the number of years since the car was purchased. To the nearest tenth of a percent, what is the monthly rate of depreciation?

A 1.5%

B 1.6%

C 9.2%

D 18.0%

depreciation:

0 H $\tan 30° = \frac{100}{A}$

$A = \frac{100}{\tan 30°} = 173.2$

A

25 Which expression is equivalent to $\left(\frac{16x^{\frac{1}{6}}y^{-2}}{x^{-\frac{1}{6}}y^{6}}\right)^{\frac{3}{2}}$?

A $24x^{\frac{9}{2}}y^{\frac{9}{2}}$

B $\frac{24x^{\frac{3}{4}}}{y^{9}}$

C $\frac{64}{x^{\frac{1}{2}}y^{8}}$

D $\frac{64x^{\frac{1}{2}}}{y^{12}}$

$16^{\frac{3}{2}} \times x^{\frac{1}{6}(\frac{3}{2})} y^{-2(\frac{3}{2})}$ / $x^{-1/6(3/2)} y^{6(\frac{3}{2})}$

This is the end of the multiple-choice portion of the test.

$y = \frac{K}{x}$

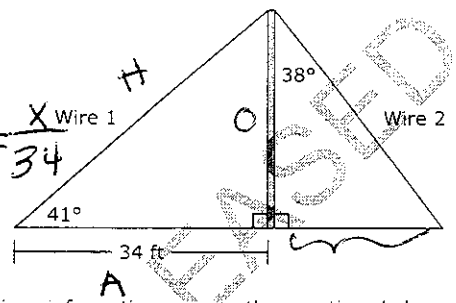
$50 = \frac{K}{8}$

$K = 400$

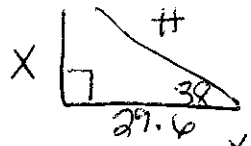
The questions you read next will require you to answer in writing.

1. **Write your answers on separate paper.**
2. **Be sure to write your name on each page.**

1 In the figure below, a pole has two wires attached to it, one on each side, forming two right triangles.



$\tan 41° = \frac{x}{34}$



$\tan 38 = \frac{x}{29.6}$

Based on the given information, answer the questions below.

- How tall is the pole? 29.6 ft
- How far from the base of the pole does Wire 2 attach to the ground? 23.1 ft
- How long is Wire 1? ≈ 45.1 ft

$34^2 + 29.6^2 = \text{wire1}^2$ or $\cos 41 = \frac{34}{x}$

2 The amount of time it takes to build a road varies inversely with the number of workers building the road. Suppose it takes 50 workers 8 months to build the road.

- What is the constant of variation? 400
- Write an equation that could be used to determine how long it would take *n* workers to build the road. (Be sure to define the variables.)
- How much faster would 60 workers build the road than 50 workers?

A little faster than a month

$n = \frac{400}{t}$

$60 = \frac{400}{t}$ $t = 6.\overline{6}$